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Review Article

Nutritional Evaluation of Jamun Fruit and Development of Value-added Product Squash

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Abstract

Syzygium cumini, commonly known as jamun, is a tropical plant that produces purple, oval, fleshy fruits. Ripe fruits have a slightly sweet taste and can be used to prepare drinks, jellies, juices, squash and wine. Jamun is highly nutritious and perishable it has an important nutritional value, it contains anthocyanin and a good source for diabetic and analgesic properties. Chemical and mineral composition of jamun fruit was carried out at PCSIR labs Lahore Pakistan, with the aim to develop value added products and to evaluate its quality parameters.

Edible portion of fruit analyzed for nutritional composition, physical parameters and mineral content and found total sugars 7.91%, total soluble solids 13.27%moisture 80.7%, fiber 1.81% Acidity 2.41 and vitamin C 48.95mg/100g. value added products jamun fruit squash developed and analyzed. Fresh fruit n contained more vitamin C (45.95) as compared to fruit squash (18.3). TSS/brix of fruit squash recorded (65.2oB). after nine-point hedonic scale organoleptic evaluation. The chemical composition of Jamun shows that its fruits are low in fat and high in vitamin C low in total sugars but the developed value added product jamun squash has low in vitamin C high in total sugars. The developed jamun squash is nutritious, energizing and tasty and can be used by all age groups.

Keywords: Jamun; Nutritional Analysis; Value Added Product; Squash

Jamun is a large green tree famous in the Indo-Pak region. Its scientific name is Eugenia jambolana or *Syzygium cumini* and it belongs to the myrtle family. Jambul, Java plum, and black plum are the common names of jamun [1]. Globally, total jamun production is 13.5 million tons, of which Pakistan and india produces 17.4%.

Figure 1

Jamun fruit is rich in iron and can be used to treat diabetes, liver and heart diseases. Berries also contain large amounts of anthocyanins, which have good antioxidant properties [2]. Jamun fruits are oval, 2-3 cm long and have a drupe. The fruit has a bitter taste and its shape and color resemble blue berries [3]. Jamun fruit is often considered to be very good for its effects on the pancreas, especially its anti-diabetic properties. Jamun seeds also contain proteins, fats, glycosides, alkaloid Jambosine, resins, ellagic acid, quercetin, gallic acid and elements of zinc, vanadium, chromium, sodium and potassium. $-Gutterol is found in the negative components of oilseeds. A study conducted two years ago showed that jamun had the best antioxidant properties [4]. However, ellagic acid and the glucoside jambolin are considered bioactive components of jamun that have antioxidant properties and the ability to convert starch into sugar. Jamun fruit is widely used due to its high vitamin C and anthocyanin content. The main anthocyanins in jamun fruit are malvidin, glucoside, petunia and cyanide [5].

Materials and Methods

The ripened juman fruits were collected from PCSIR Laboratories Lahore orchid and initially, physically evaluvated for weight, color, size, pulp, seed and peel [6] then nutritionally analyzed after proximate analysis the fruit processed at fruit and vegetable processing laboratory Food and biotechnology research center PCSIR Lahore. Other additives and preservative Potassium metabisulphite, citric acid, and pectin purchased from Lahore local market. The value added therapeutic food product developed in the same lab.

Nutritional analysis

Quantification of moisture, fat, fiber, protein, ash and nitrogen-free extract (NFE) of jamun fruit and squash according to AOAC protocol [7]. All tests were performed in triplicate.

Moisture content

Moisture in jamun fruit was determined by drying the samples in a hot air oven (Model: DO-1-30/02, PCSIR, Pakistan) to constant weight at 105° C ± 5° C. AOAC Method No. 934-01 [7]. Calculate the moisture content according to the equation below:

$$\text{Moisture (\%)} = \frac{\text{Weight before drying} - \text{Weight after drying}}{\text{Weight of sample (g)}} \times 100$$

Crude fat

Crude fat content determined by Sox let extraction unit (Model: H-2 1045 Extraction Unit, Hoganas, Sweden) following the procedures of AOAC (2006) Method No. 920-39 [7].

$$\text{Crude fat (\%)} = \frac{\text{Weight of flask} - \text{Weight of flask with oil}}{\text{Weight of sample (g)}}$$

Crude fiber

Crude fiber obtained from lean samples was processed by Labconco Fibertech (Labconco Corporation Kansas, USA) first with 0.255N H2SO4 for 30 minutes and then with AOAC Route No. Digested with 0.313N NaOH solution as described in 1. 978-10 [7]. Then the samples were filtered and washed with distilled water.

$$\text{Crude fiber (\%)} = \frac{\text{Weight of digested sample after drying} - \text{Weight after ashing}}{\text{Weight of sample (g)}} \times 100$$

Crude protein

AOAC Method No.948 used to determine the protein content of the sample using a Kjeltech instrument (Model: D-40599, Behr Labor Technik, Gmbh-Germany) as described in 1. 984-13 [2]. Digested the jamun fruit with a concentrated solution as per procedure. Using a nutrient mixture (100:5:10 K_2SO4: $FeSO_4$:Cu SO_4), add H_2SO_4 until the color becomes clear. The digested material was then diluted to 250 mL in a beaker. Place 10 mL of 40% NaOH and 10 mL of the digested sample into a distiller and collect the ammonia in a separate container containing 4% boric acid solution using methyl red as an indicator. This produces ammonium borate, which is used to determine the nitrogen in the sample. Therefore, the percentage of nitrogen in the sample was estimated by titrating the distillate with 0.1 N H2SO4 solution until its color became pink. Crude protein content is calculated by multiplying the percentage nitrogen (%N) by the ideal value (6.25).

$$\text{N(\%)} = \frac{\text{Vol. of 0.1N } H_2SO_4 \text{ x 0.0014x Vol. of dilution (250ml)}}{\text{Vol. of distillate sample taken x Weight of sample}}$$

Crude protein (%) = Nitrogen (%) x 6.25

Total ash

Cut directly from the ash on each dry sample Carbonization Then until no white residue remains (AOAC, method number 942-05) is placed in the muffle furnace (MF-1/02, PCSIR, Pakistan) at 550°C [7].

$$\text{Ash \%} = \frac{\text{Weight of ash}}{\text{Weight of sample}}$$

Nitrogen free extract (NFE)

Jamun NFE in fruits and seeds Calculation according to the following formula

NFE % = 100 – (Moisture% + CP % + CF1 % + CF2 % + Ash %)

where,

CP = Crude protein

CF1 = Crude fat

CF2 = Crude Fiber

Processing of pulp and development of value added product squash

The jamun fruit thoroughly washed and passed through pulpier and obtained pulp using pulpier machine. Jamun fruit pulp used to develop fruit squash. The product developed according to PCSIR fruit and vegetable processing laboratory developed methods. Five kg pulp pasteurized up to 85C the product developed according the below given flow sheet chart.

Flow sheet chart of jamun squash

The developed product jamun squash analyzed for organoleptic evaluation, TSS (Total Soluble Solid Content), moisture, fat, fiber, ash, total sugars, protein, acidity and mineral contents.

Sensory and organoleptic evaluation of jamun squash:

Sensory and organoleptic evaluation for overall acceptability, taste, appearance, flavor, color and consistency conducted by lar-

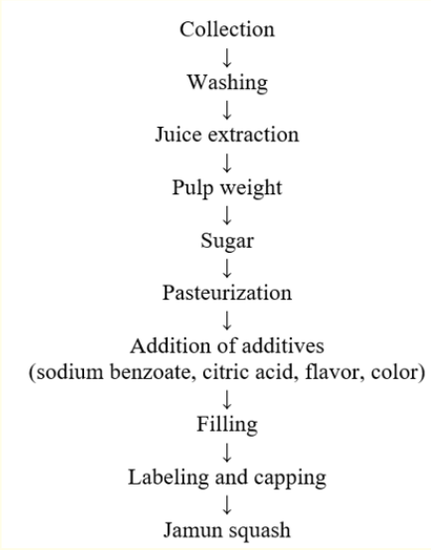

Figure 2

mond nine-point hedonic scale [8]**.** experienced panel selected they have ability to discriminate range of attributes of product examination of beverages. Before organoleptic evaluation orientation program was organized for panel members. The developed value added products jamun squash provided to the members. Proforma given to note their observation and feelings. Larmond nine-point hedonic scale range given on the performa [8] i.e. 9=Liked extremely; 8=Liked very much; 7=Liked moderately; 6=Liked slightly; 5=Neither liked nor disliked; 4=Disliked slightly; 3=Disliked moderately; 2=Disliked very much; 1=Disliked extremely. The panelists expectorated the samples and rinsed mouth using drinking water between samples. The experiment was repeated twice and the values are presented as means**.**

Results and Discussion

Physical parameters

The collected jamun fruit was dark purple and oval shaped. The weight of fruits ranged from 7.1- 6.8 grams' length 2.8cm and width 2.2cm and the total proportion of pulp, seed and peel were 4.6, 2.3 and 0.2 grams respectively. The fruit demand and value depends on color, maturity and size. The data for physical properties of jamun fruit presented in table 1. Kashaninejad., *et al*. and Bart-Plange and Baryeh [9,10], indicated that to judge the healthy growth of jamun length wise growth of jamun had more beneficial than width wise growth.

Nutritional composition of Jamun fruit

Nutritional composition of Juman fruit and jamun squash were analyzed. The analysis performed in duplicate for result calculation as mean. nutritional composition data of jamun fruit shown in

Table 1: Physical parameter evaluation of jamun fruit.

S. No	Parameters	Attributes
1	Weight	7.1 gram
2	Color	Dark purple
3	Shape	Oval
4	Length cm	2.81
5	Width cm	2.27
6	Pulp	4.6 g
7	Seed gm	2.3 g
8	Peel	0.2

table 2. The average total soluble solid content to fresh fruit is 13.27 percent moisture was 80.70%, fat 0.79% fiber 1.81% crude protein was 2.27%, total ash content 2.10%, NFE 12.23% total energy kilo calorie was 62.42, total sugars 7.91%. The present results are consistent with the findings of Ali., *et al*. (2013) [1], who found that jamun fruit contains 86.24 ± 1.45% moisture, 4.37 ± 0.04% crude protein, 1.60 ± 0.02% crude protein. Fiber: 2.09 ± 0.03% crude oil, 4.51 ± 0.12% ash. Similarly, Baliga., *et al*. (2011) [2] studied jamun fruit and found that jamun fruit contains 85.9 ± 1.4% moisture, 1.4 ± 0.7% crude protein, 0.6 ± 0.2% crude fat, 0.6 ± 0.06%. crude fiber and found that it contained 2.13 ± 0.11 crude fiber. % ash content [3]. As for as the nutritional composition of the jamun fruit is a good source of vitamin C i.e. it has 48.95mg/100g, titrate able acidity i.e. 2.41%. Mineral contents of jamun fruit are also presented in table 2. That has a vitol roll in body, the total determined mineral potassium 148.9mg/100g, calcium 80.8mg/100g, Magnesium26.18mg/100g, sodium 12.01mg/100g, iron 4.41mg/100g and zinc 0.45mg/100g. There is a variation in mineral content of blackberry reported by V.R. de Souza., *et al*. [11], USDA (2013) [12], Hakala., *et al*. [13], Tosun., *et al*. [14], they have reported that presence of potassium 79.73mg/100g, calcium 7.25mg/100g, magnesium 15.70mg/100g, iron 1.28mg/100g, Zinc were 0.20 mg/100g respectively.

Table 2: Nutritional composition of jamun fruit.

S. No	Parameters	Result	Parameter	Result
1	Moisture	80.70%	pH	3.81
2	Fat	0.79%	Acidity	2.41
3	Fiber	1.81%	Vitamin C	48.95mg/100g
4	Protein	2.27%	Potassium	148.9mg/100g
5	Ash	2.10%	Calcium	80.8mg/100g
6	NFE	12.33%	Magnesium	26.18 mg/100g
7	Energy K.Cal	62.42	Sodium	12.01mg/100g
8	TSS (Brix)	13.27 B^0	Iron	4.14mg/100g
9	Total Sugar	7.91%	Zinc	0.45mg/100g

Sensory evaluations were employed after development of value added products using nine-point hedonic scale (Larmond, E., 1977) [8]. The products examined to its appearance, flavor consistency, taste and overall acceptability as shown in Table 3. On the basis of organoleptic and sensory evaluation the jamun squash was liked very much and got highest score.

S. No	Parameters	Result
1	Appearance	8.7
2	Flavor	8.8
3	Consistency	8.2
4	Taste	8.6
5	Overall acceptability	8.7

Table 3: Organoleptic evaluation of Jamun Squash.

Chemical composition of jamun squash

Jamun squash developed by addition of sugar and jamun pulp with to a thickness of 65-degree brix. The chemical composition of developed value added product presented in table 4. The Vitamin C contained in jamun squash was 18.3 100g. It was found that jamun fruit has more vitamin C 48.95, due to heating and dilution with sugar.it is suggested that the fresh jamun consumption is more beneficial than the use of squash for vitamin C intake. The pH value of the developed products recorded was 3.6 in jamun squash while the fruit has 3.8 pH. The total titrate able acidity of fresh fruit of jamun was 2.41while squash has 0.7, total sugar content of developed product jamun squash was 40.1 while in jamun fruit was 7.91. The developed products jamun squash has recorded total ash content 2.9 while the fresh fruit pulp has 2.10%. that is good indicator for measure of total amount of mineral contents. Total soluble solids (Brix) of fresh fruit was 13.27B^0 while the jamun squash has 65.2 it is due to addition of sugar and other additives for product development.

Table 4 chemical composition of developed product jamun squash.

S. No	Parameters	Result
1	Moisture	34.8
2	Vitamin C mg/100g	18.3
3	pH value	3.6
4	Total titrate able acidity	0.7
5	Total sugar %	40.1
6	Total soluble solids (TSS)	65.2
7	Total Ash content %	2.9

Table 4: Sensory and organoleptic evaluation of developed product jamun squash.

Conclusion

It is concluded that jamun has lot of pharmaceutical and medicinal benefits. it is highly nutritious and good source of vitamin C zinc iron and minerals. Jamun is commonly a minor or underutilized fruit in Pakistan the collected data from this study can be used and help to control post-harvest losses of jamun fruit and development of value added products and may be a source of income generation for farming community. The developed value added product jamun squash well accepted and liked very much and got highest score, hence considering its nutritive value and liked very much organoleptically the jamun squash can be developed commercially for human consumption and can be used as a new source of income generation for farmer community of Pakistan. It is also suggested further studies also be conducted in future for development of therapeutic value added products from jamun fruit.

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Research Ethics Committee Approval

The research paper was submitted with the consent of the Director PCSIR laboratories Lahore and it was permitted to be published in any open access journal.

Conflicts of Interest

The authors of the paper have no conflict of interest.

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